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some time in Grace Church, New York. In this system the hammers of the bells are worked from a key-board, like that of a piano, and the largest sized bells can be played as easily and quickly as a piano itself. The mechanism is very simple, the keys making contacts which actuate relays, and these in turn excite solenoids with iron plungers, to which are attached the bell ropes. Instead of the key-board, a small cylinder, like that of a music-box, can be used, which automatically plays the chimes every hour or quarter.

The most valuable part, however, is the electric tower-clock arrangement. In this, instead of the ordinary cumbersome clock-movement requiring frequent rewinds, an ordinary clock is used, which may be placed anywhere, in an office, for instance. Every minute this clock makes a contact, which actuates a little battery motor, and this turns the hands of the tower-clock one minute ahead. As the impulse is given at the middle of the minute, the tower hands are never more than half a minute out of time. The actuating clock may be synchronized from Washington if desired. This system seems to give a very good tower clock for a fraction of the present price. One advantage is the fact that no winding is required, six or seven Leclanche cells furnishing enough current to run the clock for several years.

Another exhibit which will be gladly hailed by those who have had to do much telephoning will be the automatic telephone exchange in the gallery of the electrical building. In this system, the telephones are the same as usual, but in front of the wooden box which supports the transmitter are placed a number of keys. If a subscriber wishes to call up number 1324, for instance, he presses key number 1, once; key number 2, three times; key 3, twice; and key 4, four times. He then presses another key, and if the subscriber he wishes to communicate with is talking to some one else, it signals him that fact; if the line is open, it puts him in communication. When he is through, he presses the key again, and it disconnects him.

Several central offices have been put in, and are working satisfactorily, and a number of other cities have decided to replace their present central office by this automatic system.

At present there is one disadvantage which the system has, i.e., the need of four wires instead of two; but, from an examination of the machines, there seem to be several ways by which two wires could do all the work, and doubtless this improvement will soon be made. Even with the increased expense, the better service will more than compensate for the increased cost in wiring, and, of course, the central station expenses will be much reduced.

A very complete exhibit is that of the Bell Telephone Company. This includes an interesting historical exhibit of the various forms of telephone receivers and transmitters invented by Mr. Bell. A central station is shown at work, the methods of connecting up the lines, etc.

One of the new things is the use of paper insulation for telephone cables. Seemingly impracticable as this seemed to be a few years ago, it is now a complete success. Of course, it is evident that its low specific inductive capacity gives it marked advantages over any other kind of insulation, and that by its use speech could be made clearer, and transmitted further, but it would at first sight appear that it would be difficult to keep up its insulating qualities. This, however, has been done, and nearly every switchboard observed was wired with this insulation. The operation of putting it on the wire is shown in the Electrical Building.

R. A. F.

LETTERS TO THE EDITOR.

* * * Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Peculiar Nesting of a King-Bird.

A CURIOUS incident, showing a peculiarity of bird-life, came under my notice within the last month (June, 1893). We have been boring an artesian well about five miles south of Beaumont, mound rising out of the great coastal prairie lying

between Beaumont and Sabine Pass, in Jefferson County, Texas, and in the course of the operations have built a derrick about seventy-five feet high. After the derrick had been built a few weeks, it was visited by a great number of birds of various kinds, whether with a view of locating or not, I do not know, but one would think a well outfit, with all its noise and wet, a very unfavorable location for bird-life. Among the visitors came a pair of king-birds (*Tyrannus tyrannus*), which, after an apparently careful inspection, became convinced that they had found a satisfactory location for their home. A sheltered point, where two of the cross-beams came together in a corner of the derrick about twelve feet from the ground, was selected and the pair began building a nest. Notwithstanding the noise of the machinery and the continual passing up and down of the man in the derrick (the nest was built in the same corner as the ladder is located on the outside of) the nest was completed and three eggs deposited. Then something occurred that killed the female, and the male, after moping around for a day or two, also disappeared. That, I thought, was the end of that pair's nesting; but apparently not, as in a day or two the same male bird returned, bringing with him another mate. The outlook was again considered, and the pair began building another nest in the same location, resting the new nest on the top of the old one, building, as it were, a second story to it. After the new nest was completed, but before any eggs had been deposited, wondering what could have become of the eggs already laid, I went up the derrick, and, carefully raising the new structure, brought out the old eggs. Replacing the new nest as best I could, the birds continued to occupy it, and the female is now setting upon a full nest of eggs of her own laying, and I am now looking forward with considerable interest to the advent of a young brood to see how they will thrive under the circumstances.

I have asked several of my ornithological friends if such an occurrence has anywhere come under their observations, but have in all cases received a negative answer.

WM. KENNEDY.

Austin, Texas, June, 1893.

The Tucumcari Fossils.

In *Science*, May 26, pp. 282-283, there is an article by Mr. W. F. Cummins of the Texas Geological Survey, entitled "Geology of Tucumcari, New Mexico," in which he says: "Mr. Marcou . . . endeavors to avoid the conclusion (that the beds are Cretaceous) by saying that either the determinations of the fossils found by me were incorrect or that they did not come from that locality, and suggests that the labels on my packages were loosely put on and became mixed with collections made elsewhere; and on this flimsy subterfuge (to give it no harder name) still insists on the correctness of his reference to the Jurassic."

Mr. Cummins tells at length of the good care he took not to have any confusion of labels. So my suggestion cannot stand. I accept fully the explanation.

Now there remain two points, which are the most important: First, the correctness of the determination of the fossils; second, the stratigraphic position of the Jurassic strata of the Tucumcari between the Trias and the lower beds of the Neocomian, at Comet Creek, an affluent of Washita River, and at the great band of the Canadian River.

1. Mr. Cummins says: "myself and my assistants discussed the fossils in the field as we picked them up, and our note-books show that we then determined them as they are now designated." . . . "I made up small suits and sent them to various parties for determination, . . . and there was unanimous agreement as to all the species I have published." It is important to add an explanation as regards the species published. Only one species has been published by Mr. Cummins, a leaf of a fossil plant; all the invertebrate fossils are only quoted, without descriptions or figures. Here is the list given by Mr. Cummins:

"*Gryphaea dilatata*, var. *Tucumcarii* Marcou; *Ostrea marshii*, as determined by Marcou, but in reality *Ostrea subovata*, Shumard; *Gryphaea pitcheri*, Morton; *Exogyra texana*, Romer; *Ostrea quadruplicata*, Shumard; *Trigonia emoryi*, Con.; *Cardium hillani*, Sow.; *Cytheria leonensis*, Con.; and a single leaf of a dycotyledonous plant, which I described and figured under the name

Stereulia drakei. It will be apparent to everyone acquainted with the fossils of the Cretaceous that those enumerated belong only to Cretaceous strata."

It would have been well if Mr. Cummins had given the names of the "parties," as he calls the experts, for in no other part of geology is it so important to know the paleontologists who determined the fossils. When in the field in 1853 I determined the *Gryphaea* as the *Gryphaea dilatata*, or a variety of it, of the Oxfordian of Europe, and the *Ostrea* as a *Ostrea marshii* of the Lower Oolite of the Jura. After my return from the field, I submitted my fossils to Louis Agassiz, Alcide d'Orbigny, de Verneuil, d'Archiac, Pictet, etc. M. de Verneuil, an excellent paleontologist, as well known in America as in Europe, reported on my fossils before the National Academy of Science of France, and called them *Gryphaea dilatata* and *Ostrea marshii*; and he refers the Tucumcari strata to the Jura. Finally, I have given long descriptions and excellent figures of the two fossils in my volume, entitled "Geology of North America," and also in *Bulletin Société Géologique de France*, vol. xii., 1855. So my two fossils had received all the attention possible, and can be regarded with safety as correctly determined.

Let us see now what guarantee we have as to the correctness of the determination by Mr. Cummins and his "various parties for determination" of his fossils, as he calls his anonymous paleontological assistants. The value of determination of fossils depends much on the name of the paleontologist employed. To be sure, anyone, even the greatest paleontologist, makes mistakes; but it is generally admitted that they are less liable to errors than others. Mr. Cummins is unknown as a practical paleontologist. Until three years ago, he was regarded as a collector of fossils in Texas who has supplied two paleontologists, Messrs. Cope and C. A. White. In this case Mr. Cope has nothing to do, for all the fossils are invertebrates. Mr. White has charge of the Mesozoic invertebrate fossils at the U. S. National Museum, and Mr. Cummins, in a letter to me, says that he did send his Tucumcari fossils to Washington for determination. So it may be assumed that Mr. White is one of the experts, who has agreed to the determinations made by Mr. Cummins. Now Mr. White, during twenty years, has constantly confounded, in all his paleontological memoirs, the *Gryphaea dilatata*, var. *tucumcarii*, with the *Gryphaea pitcheri*; and more, he has said, in some of his papers, that the Lower Cretaceous of Europe has no representative in North America.

As regards my other fossil, the *Ostrea marshii*, which, according to Messrs. Cummins and White, "is in reality *Ostrea subovata*, Shumard." I shall quote from a letter of Mr. Cummins to me, dated Feb. 25, 1892: "I have compared the Tucumcari specimens with *O. subovata*, Shumard, and do not believe they are the same." And I shall tell what occurred in my house during the last visit of Mr. White, in 1884. Mr. White took up a fossil on my chimney mantel-piece, looked at it attentively, and exclaimed: "What a beautiful Cretaceous fossil; it is the most perfect I have ever seen from Texas." My answer was: "The fossil is not Cretaceous; it is the typical *Ostrea marshii*, picked up, with my own hand, in the Lower Oolite of the Jura Mountains at Frickberg, in Argovia, Switzerland." Every one can draw his conclusions as to Mr. White's ability to determine specimens of the *Gryphaea dilatata* and *Ostrea marshii* types.

I have said already before in another paper, and repeat it, that it is impossible to find the typical *Gryphaea pitcheri* (I mean the one described and figured in my "Geology of North America," Plate iv., Figs. 5 and 6) in the same bed with the *Gryphaea dilatata*, var. *tucumcarii*, and the *Ostrea marshii* of Pyramid Mount, on the Tucumcari area.

As to the *Exogyra texana* quoted by Mr. Cummins, it is an incorrect determination of a fossil having some distant affinity of forms. The four or five other fossils in Mr. Cummins's list, are, at all events, not sufficiently characteristic, even if properly determined, for "the conclusion that the beds are Cretaceous."

2. As to the stratigraphic position of the Jurassic strata of the Tucumcari, it is so clear and so striking that a few words will dispose once more of the question. At the Tucumcari there is no discordance of stratification or interruption of any sort between

the Trias beds below and the Jurassic beds above. It is a continuous series, with most striking differences in the lithology and paleontology between what is Trias and what I call the Jura. How far those deposits extended eastward and southward, it is difficult to say in the present condition of our limited knowledge of the geology of Texas. Very likely they did extend eastward all over the Indian country of the Comanches, Kioways, Kichais, and Delawares, as far as near Topofki Creek and Delaware Mount; southward they went as far as the upper part of the Trinity River basin, and covered all the upper Brazos and upper Colorado Rivers of Texas. After their upheaval above the sea, at the end of the Jura period, erosions on a great scale occurred and swept away all the Upper Trias and a part of the Middle Trias to such an extent as to reduce the plateau of the Jura Trias nearly to the actual Llano Estacado, obliging it to recede from the vicinity of Topofki Creek several hundred miles westward. Then over the eroded part of the Middle Trias, at Fort Washita, at Comet Creek, and at the Great Bend of the Canadian River, an arm of the Lower Cretaceous sea, extended in a narrow strip, as a sort of gulf, which extended as far north as southern Kansas, according to Mr. Cragin's discoveries.

In that gulf, strata, mainly of limestone, were deposited; and at Comet Creek, on the Washita River, where I saw it in 1853, those limestone rocks are a perfect mass of *Gryphaea pitcheri*, with some *Caprotina texana* at the base of the formation. The division of the Texas Cretaceous, to which those "*Gryphaea pitcheri* limestones" belong, has been called since "Fredericksburg Division," and are the homotaxis or equivalent of the Lower Neocomian of Europe, as I have always said ever since.

Mr. Cummins says there is no disagreement between him and Mr. Hill as to the age of the strata of the Tucumcari, which are referred by them to the "Denison beds" of the "Washita Division;" that is to say, a group of strata far above, and consequently younger, than the Comet Creek beds with *Caprotina* and *Gryphaea pitcheri*. So, according to Messrs. Cummins and Hill, the Tucumcari strata, which they call "Denison Cretaceous beds," were deposited in perfect concordance on the top of the Upper Trias, and long after the deposit of the Fredericksburg Division at Comet Creek. A material impossibility, against all stratigraphic and paleontologic principles of formation in a flat country over immense plains; for there is no doubt that the Neocomian strata of Comet Creek, deposited in interrupted discordance over the strata of the Middle Trias, are younger than the strata of Tucumcari, deposited in perfect concordance of stratification, without any interruption, over the uppermost part of the Upper Trias.

What a strange story, unique in the annals of geographical geology. A description of the Tucumcari area, made simply during a difficult and even then dangerous exploration, with all the proofs, stratigraphic, paleontologic, and lithologic, has stirred up an opposition without precedent as regards its long duration. Now—June, 1893—it is forty years since I started from Boston for my exploration by the thirty-fifth parallel, for a Pacific railroad from the Mississippi River to the Pacific Ocean; and, although one concession has been made in my favor, by almost all my adversaries—the correctness of my reference of the lower beds of the Tucumcari to the Trias—the opposition continues, with a degree of intensity and, I am sorry to say, of unfairness never equalled.

Mr. R. T. Hill, after his two visits at the Tucumcari, in 1888 and 1891, has not yet published anything reliable, only a few contradictory statements, without proofs and against plain stratigraphic and paleontologic facts.

Mr. A. Hyatt, after a thorough exploration of two months' duration of a part of the Tucumcari area in 1889, asked me to look over with him his quite extensive collection of fossils, and placed before my eyes his detailed sections of Monte Revuelto. I did not see a single fossil in his collection which can be called a Cretaceous fossil; when, on the contrary, the *Gryphaea* and *Ammonites* had all the most indisputable characters of Jurassic fossils.

For some unknown reasons, not only the report of his exploration has not been published, but even his administrative report as head of a special exploration of the U. S. Geological Survey, in

which each explorer gives, every year, the summary of the work done to the director of the survey, has not yet been issued, although the volume in which it ought to be inserted was printed three years ago. The stopping of the distribution of the "Eleventh Annual Report" is somewhat mysterious. Two other printed Annual Reports, the twelfth and thirteenth, remain also undistributed, waiting for the distribution of the eleventh.

Mr. A. Hyatt, in a printed letter in *The American Geologist* for April, 1893, p. 281, admits that his verbal opinion, quoted by me at page 213 of the same periodical, "is correct;" but that he had "at present absolutely no opinion about the age of rocks of this region." A rather curious conclusion for an explorer who has passed two months on the same ground where I was only two days, and who has studied the collection of fossils he made during a whole winter.

Evidently there is some secret about it. My old adversaries, almost all alive now, with the exceptions of the two Shumards, Meek and Newberry, are still at work against me. But I have resisted their combined attacks during forty years, and I can continue very well the defence of my observations and opinions.

However, I shall say nothing more for the present, waiting until after the publication, by some paleontologist, of the fossils collected at the Tucumcari by Messrs. Hill, Hyatt, and Cummins, with descriptions and good figures; for it is absolutely useless to discuss any longer, without proper documents in the hands of geologists, in order that everyone interested in the question may be able to judge for himself as to the conclusions arrived at by the different parties.

JULES MARCOU.

Cambridge, Mass.

Natural and Artificial Cements in Canada.

YOUR issue of March 31, 1893, contains an article on "Natural and Artificial Cements in Canada," which in part is incorrect, and I wish to set you right with regard to the class of raw material from which the "Star" Portland cement is manufactured.

In the first place, Star cement is manufactured from shell marl, which is thoroughly decomposed, and containing from 95 to 98 per cent pure carbonate of lime, the clay used is an alluvial blue clay.

The analyses of our clays and marl show them to be of superior quality and equal to any deposits of a similar nature; this has also been fully demonstrated in the practical results obtained by users of the cement when manufactured.

E. BRAVENDEE.

Napanee Mills, June 12.

Sound and Color.

On reading Professor Underwood's paper on the above subject in *Science* for June 16th, some rather peculiar experiences of my own, which I have never read or heard of in others, were freshly brought to mind.

When intently listening to certain, but by no means all, eminent speakers, and to a few operatic singers of great renown, I have for some years past distinctly detected, or rather have involuntarily become conscious of, an emanation of color from the head of the speaker or singer with each distinct tone of the voice. The more impassioned the words and tones the more intense the color, and the larger the visible aureole or color area. The color has thus far been limited, with a few exceptions, to a transparent and ethereal but decided blue. It emanates suddenly with each explosion of sound, passes upward like a thin cloud of smoke, and fades like a swiftly dissolving view. I noticed it for the first time while listening to Professor Felix Adler, later on when listening to Colonel Ingersoll, faintly over the head of William Winter; again quite distinctly in case of General Sherman and General Horace Porter, faintly in case of some other public speakers, including Anna Dickinson, Helen Potter, the elocutionist, and some eminent divines, but not at all in case of President Cleveland and some other equally prominent public men.

In case of singers, the most noted instances I can recall are the DeRetszke brothers, Jean and Edward, Mdme. Emma Eames, Lilli Lehmann, Mdme. Albani, Vogel, and Gudehus.

In case of Mdme. Lehmann the blue color verged towards a liquid green, and with Albani it was a pale sheen of silver vapor. In case of Vogel, the tenor, the aureole was an evanescent and

very pale straw color. In Mdme. Mielke the blue became a velvety purple or violet. Mdme. Nordica emitted an aureole of pale, translucent gold; Emma Juch gives me the impression of a delicate and liquid pink, while Patti seemed to emit no distinguishing color, but rather a kaleidoscopic blending of many colors.

I should be glad to hear from others who have noted similar phenomena, for I have been inclined to question the reliability of my own impressions, vivid as they have been, and many times repeated. Professor Underwood's recital inclines me to accord them a little more respect. SAMUEL S. WALLIAN, M.D. Washington Heights, City.

Age of Guano Deposits.

THE following particulars, recently given me by a friend who, years ago, was a sailor, and whom I know to be a man of the strictest veracity, may be of interest as possibly throwing some light on the age of guano deposits.

In the year 1840 his vessel loaded with guano on the island of Ichabo, on the east coast of Africa. During the excavations which were necessary, the crew exhumed the body of a Portuguese sailor, who, according to the head-board, on which his name and date of burial had been carved with a knife, had been interred fifty-two years previously. The top of this head-board projected two feet above the original surface, but had been covered by exactly seven feet of subsequent deposit of guano.

ROBERT RIDGWAY.

U. S. National Museum, Washington, D.C., June 23.

Correction.

IN 1887 I published in the *Canadian Record of Science* an account of a Permian glacial moraine in Prince Edward Island. I have recently examined this formation more carefully, and am not at all positive about its age. The bedding and jointage are conformable with the underlying formation, but the cementing material is purely calcareous, and the induration, though complete, may be recent. In the absence of organic evidence, I do not think we can positively say that this conglomerate is not Quaternary.

F. BAIN.

North River, P. E. Island.

BOOK-REVIEWS.

Geological Survey of Missouri. Vol. II. A Report on the Iron Ores of Missouri. By FRANK L. MASON. Jefferson City, December, 1892. Plates, Map, etc. 366 p.

Vol. III. A Report on the Mineral Waters of Missouri. By PAUL SCHWETZER. Jefferson City, December, 1892. Plates, Map, etc. 256 p.

THERE are but few States in the Union that have not had at some time or other geological surveys of a part or the whole of their territory. As a general rule, the surveys have been conducted by different geologists, the same one seldom holding his position for a long period, and, in point of fact, the survey itself frequently ending before a decade has elapsed. There are, of course, notable exceptions to this, Minnesota, for example, where the State geologist has issued twenty annual reports, and New York, which has enjoyed an almost uninterrupted existence since 1836. Yet more remarkable in this latter case is the fact that the present head of the survey has been such for nearly fifty years and was one of the original corps in 1836. This veteran, as everyone knows, is Professor James Hall, still one of the most indefatigable of all American geologists.

The State of Missouri has had numerous surveys, which have been carried on under various heads. The first survey existed from 1853 to 1862, and published five reports; the second lasted from 1870 to 1874, and issued four reports; the third from 1876 to 1879, and published only one report; while the fourth has lasted from 1889 to date, and has published three bulky volumes, of which the present ones are two, five bulletins, an atlas of maps, and a biennial report. We thus see that under the present management more work has been done than in any of the other surveys lasting twice as long.